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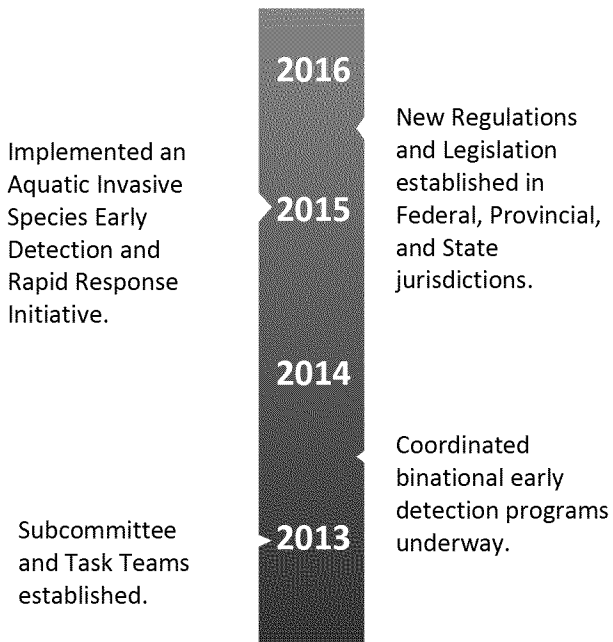
AQUATIC INVASIVE SPECIES ANNEX PROGRESS REPORT OF THE PARTIES CHAPTER

OVERVIEW

Aquatic invasive species (AIS) are undermining efforts to restore and protect Great Lakes water quality. These organisms alter the way nutrients and chemical contaminants move within the ecosystem, affecting the productivity of the lakes and integrity of the aquatic food web. Once invasive species become established in the Great Lakes, they are costly to control and nearly impossible to eradicate. Prevention is the most effective approach to dealing with this threat. The 2012 Great Lakes Water Quality Agreement (GLWQA) commits Canada and the United States to: preventing the introduction of AIS; controlling or reducing the spread of existing AIS; and eradicating, where feasible, existing AIS with the ecosystem.

Canada and the United States are working to minimize risk of Asian carps and other species invading the Great Lakes by a combination of species and pathway risk assessment and risk management actions. A second line of defence was also created by establishing an early detection and rapid response initiative with the goal of finding new invaders and preventing them from becoming established. This basinwide effort resulted in several new detections of grass carp and rapid agency responses. As a result of actions taken over the last three years, no new AIS are known to have become established in the Great Lakes; however, the recently detected evidence of Grass Carp reproduction in the Sandusky River, Ohio USA, is of great concern. Canada and the United States are committed to further improving and strengthening the AIS actions and initiatives under the Aquatic Invasive Species Annex.

PROGRESS TOWARD MEETING GLWQA COMMITMENTS



This Annex is being implemented by the Aquatic Invasive Species (AIS) Subcommittee, co-led by Fisheries and Oceans Canada and the United States Fish and Wildlife Service. The AIS Subcommittee delivers its work in close cooperation with the Great Lakes Panel on Aquatic Nuisance Species, supported by the Great Lakes Commission. Organizations on the subcommittee include: [Insert logos from: Fisheries and Oceans Canada, U.S. Fish and Wildlife Service, 1854 Treaty Authority, Canadian Aquatic Invasive Species Network, Chippewa-Ottawa Resource Authority, First Nation / Metis – Chiefs of Ontario, Great Lakes Indian Fish and Wildlife Commission, Great Lakes Commission, Great Lakes Fishery Commission, Great Lakes St. Lawrence Cities Initiative, Michigan Department of Environmental Quality, Minnesota Department of Natural Resources, New York Department of Environmental Conservation, Ohio Department of Natural Resources, Ontario Federation of Anglers and Hunters, Ontario Ministry of Natural Resources, Ontario Invasive Species Centre, The Nature Conservancy, U.S. Environmental Protection Agency, and U.S. National Oceanographic and Atmospheric Administration.]

BINATIONAL ACTIONS TAKEN FOR KEY COMMITMENTS

Note: I recommend changing the order of presentation...

(#4) By 2015, develop and implement an AIS early detection and rapid response initiative.

- Develop and evaluate early AIS detection technologies and methods.
- The AIS early detection and rapid response initiative was developed and is being implemented by Canada and the United States as a part of a number of strategies being applied to prevent the introduction and spread of AIS. Early detection and rapid response provides a strong second line of defense to prevention efforts by finding AIS populations, including Asian Carps, while they are still within a small area and responding to preventing them from becoming established. This effort

marks the first basinwide early detection effort in the history of the Great Lakes and has created a foundation for additional strengthening and enhancement. Key components include:

- An “AIS species watch list” of those species of the highest priority of risk of invading the Great Lakes.
 - A list of priority locations to undertake surveillance for the potential introduction of species on the “AIS species watch list”;
 - Protocols for monitoring and surveillance methodologies (such as environmental DNA sampling and sampling using gears that collect fishes and bottom-dwelling invertebrates) so that a potential invader is promptly observed and reported;
 - The sharing of relevant information amongst the responsible departments and agencies to ensure prompt detection of invaders and prompt actions to respond to them; and
 - The coordination of plans and preparations for any response actions necessary to prevent the establishment of newly detected AIS.
- (probably no separate bullet so it is linked to the items above) A further account of the achievements to date under the initiative is available at www.binational.net (<http://binational.net/2015/02/23/ais-early-detection/>).
 - Detections of Asian Carps in Canadian waters triggered several coordinated response efforts under the incident command system, successfully testing the Canadian domestic response framework established for Asian carps.
 - The Conference of Great Lakes Governors and Premiers have also provided critical leadership with the establishment of their Mutual Aid Agreement as the basis for the States and Provinces to share resources to deal with AIS.

An account of the achievements, to date, under the initiative is available at www.binational.net

(#1) Conduct risk assessments on AIS species and pathways for their entry into the Great Lakes.

Canada and the United States undertook an assessment of existing species risks assessments, in coordination with Great Lakes jurisdictions and their partners. Based on this analysis, a binational assessment of the ecological risks and impacts related to Grass Carp establishment was completed for peer-review.

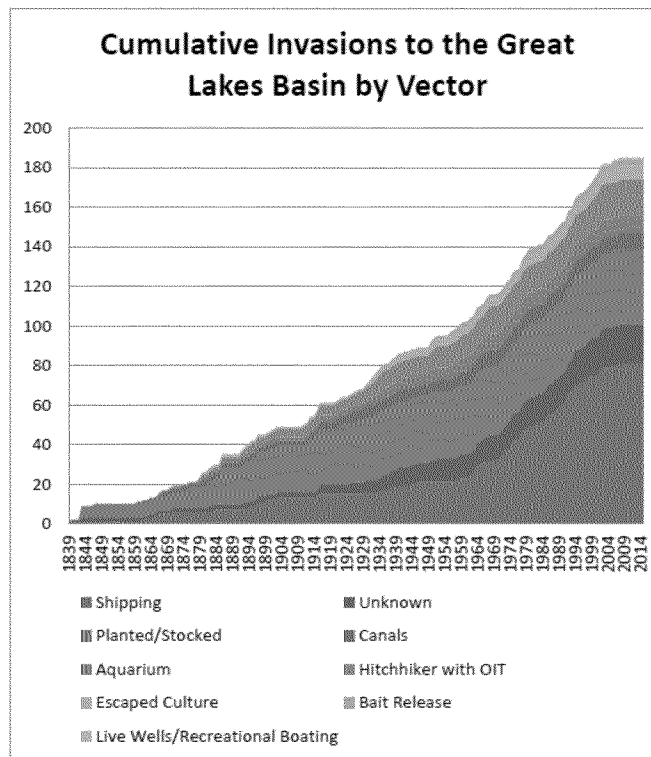
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- Members of the Aquatic Invasive Species Annex are also supporting work of the Conference of Great Lakes Governors and Premiers Aquatic Invasive Species Task Group to harmonize species risk assessments across the basin.
- A risk analysis of illegal trade and transport into Great Lakes jurisdictions was completed and a report of these findings was delivered to the Great Lakes Fishery Commission’s binational Law Enforcement Committee. The report recommends risk management efforts to address the unacceptable risks documented for regulated (state, provincial, and federal) species in the internet, live bait, live food, aquaculture, private pond/lake stocking, water garden, aquarium/pet, and cultural release pathways. The AIS Subcommittee will continue to work with the Law Enforcement Committee to address risk management needs described in the risk analysis report.
- A new web-based tool called the Great Lakes Detector of Invasive Aquatics in Trade (GLDIATR) has been developed by the Great Lakes Commission to better quantify the threat posed by the Internet commerce pathway. The tool is available to managers in the United States and Canada to inform and help target risk assessment, monitoring and surveillance, and enforcement.
- In the United States, pathway risk reduction of AIS transport in recreational boats is being pursued. A partnership with government and industry is working toward objectives of developing new U.S

recreational boat design standards for building new “AIS-Safe Boats” and U.S. standards for AIS removal from existing recreational boats.

- In Canada, a National Recreational Boating Risk Assessment, with focus on the potential movement of AIS within Canadian and United States waters of Great Lakes, was carried out during 2015 and the products of this assessment will assist in identifying areas to focus on controlling inadvertent spread of AIS by recreational boaters

Success preventing invaders

Historically, an average of one non-native species was found to be established in the Great Lakes about every 8 months. Most of those introductions resulted from ballast water discharge. No ballast-mediated introductions, and no additional introductions from other pathways, have resulted in establishment of a non-native species since 2008. The success of joint United States and Canada ballast water exchange management has been a major contributor, with no new introductions attributable to ships since 2006.



Source R. Sturtevant, GLANSIS-NOAA

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(#2) Outreach and engagement undertaken in support of meeting various annex commitments.

- While most outreach and engagement efforts are implemented domestically, experts from government agencies and non-government groups are sharing resources and approaches. To support this coordination, the binational Great Lakes Panel on Aquatic Nuisance Species, Information and Education Committee, developed a synthesis of communication and education campaigns, programs, and products. This binational coordination will enhance prevention efforts by human-mediated pathways, including recreational boating, that have the most impact on promoting behaviors that prevent the introduction and spread of AIS.

(#3) Special Binational Focus: Coordination on Asian Carps

- The Great Lakes Restoration Initiative provides support to the multi-agency and binational Asian Carp Regional Coordinating Committee, which has implemented the Asian Carp Control Strategy

Framework — including surveillance, response actions and testing of new control technologies. More information about the ACRCC is available at <http://www.asiancarp.us>

- Canada, working closely with Ontario and United States jurisdictions, has delivered its Asian Carp Program based on four pillars: prevention, early warning, response, and management. The program includes extensive early detection surveillance activities in close conjunction with environmental DNA monitoring carried out by Ontario.
- The risk of barge shipping-related transport of fishes, within the Chicago Area Waterway System, was evaluated, and the resulting report delivered to the Asian Carp Regional Coordinating Committee.
- A large scale outreach campaign specific to raising awareness and public understanding to engage them in preventing Asian carps has been carried out working with the Ontario Federation of Anglers and Hunters, the Invasive Species Centre, and Royal Ontario Museum.
- U.S. Federal partners supported the development and testing of a near-real-time environmental DNA (eDNA) surveillance tool in order to support Law Enforcement efforts relating to illegal transport of Asian carp species into Great Lakes jurisdictions.
- The U.S. tested the use of carbon dioxide as an environmentally sound approach to help contain Asian carps in the Mississippi River system. Results show promise of this containment technology at reducing the risk of Asian carps spread
- Work was initiated in the U.S. on the development and testing of a system to deliver a piscicide (Antymycin), into waters containing Bighead and Silver Carps, to reduce non-target environmental impacts. This technology could be used to reduce populations in the Chicago Area Waterway System and Illinois River, to minimize risk of establishment in the Great Lakes.

DOMESTIC ACTIONS TAKEN



Conduct risk assessments on AIS species and pathways for their entry into the Great Lakes.
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- During 2013, a national risk assessment of ballast water introductions of AIS species was completed with focus on the Great Lakes and St. Lawrence River which identified the need to reduce risk with the addition of ballast water treatment for ships from outside and for ships within the Great Lakes.
- During 2013, a peer review of available tools was carried out and science advice was published about screening-level risk assessment protocols for nonindigenous freshwater organisms in trade in Canada that provides guidance to evaluating risks to support prevention actions.

Prevent introduction and spread of AIS by developing regulations
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- With extensive public and government consultation, Canada established new aquatic invasive species regulations under the Fisheries Act in June 2015 creating new prohibitions for species based

on risk and enabling new measures for prevention and control of AIS in Canada and at its borders.

- The Province of Ontario, based on broad stakeholder input, gave royal assent in November 2015 to Bill 37 – the new Invasive Species Act – which will come into force within one year, providing tools and authorities needed to prevent and respond to all invasive species including prohibitions for high risk species.

Implement early detection and rapid response.

- Canada, working closely with Ontario and United States jurisdictions, has delivered its Asian Carp Program based on four pillars: prevention, early warning, response, and management. The program includes extensive early detection surveillance activities in close conjunction with environmental DNA monitoring carried out by Ontario.
- A large-scale outreach campaign specific to raising awareness and public understanding to engage them in preventing Asian carps has been carried out working with the Ontario Federation of Anglers and Hunters, the Invasive Species Centre, and the Royal Ontario Museum.
- Findings of Grass Carp in lakes Erie and Ontario between 2013 and 2015 have triggered successful coordinated response efforts under the incident command system testing the domestic response framework established for Asian carps.

Conduct research to develop and test AIS detection, containment, and control technologies.

- Research has been completed about the capacity for invasive fish species, including Asian Carp, to move through the Welland Canal and the St. Marys River canals to help better understand the risk of spread and opportunities for control.
- Research on repulsion devices to potentially contain and control fish species, including Asian carps, has been carried out in a large-scale mesocosm.
- Canada continues to actively research monitoring and treatment technologies to advance efforts to prevent AIS movement in the ballast water of ships.



Conduct risk assessments on AIS species and pathways for their entry into the Great Lakes.

- Approximately 160 non-native species risk assessments were conducted by the United States, and have been posted on [www.fws.gov](http://www.fws.gov/fisheries/ANS/species_risk_reports.html) (http://www.fws.gov/fisheries/ANS/species_risk_reports.html), with additional species risk assessments to be undertaken and posted. Climate matches for these species show a degree of establishment risk in the Great Lakes Basin, if those species are introduced in numbers large enough to establish self-sustaining populations.
- The risk of barge shipping-related transport of fishes, within the Chicago Area Waterway System,

was evaluated, and the resulting report delivered to the Asian Carp Regional Coordinating Committee.

Prevent introduction and spread of AIS by developing regulations

- Based on risk assessments and supporting science, the state of Michigan amended its prohibited species list to include several new invasive species <http://www.michigan.gov/invasives/0,5664,7-324-68071---,00.html>
- The U.S. Fish and Wildlife Service has proposed adding 11 nonnative freshwater species to the list of injurious species under the Lacey act. There are 10 fish (crucian carp, Eurasian minnow, Prussian carp, roach, stone moroko, Nile perch, Amur sleeper, European perch, zander, wels catfish) and 1 crayfish (common yabby).

Implement early detection and rapid response.

- Great Lakes states are have been actively monitoring and responding to detections of invasive species, including recent responses for invasive Water lettuce, New Zealand Mudsnail, Parrot Feather, Red Swamp Crayfish, Water Hyacinth, Water Chestnut, European Frogbit, Starry Stonewort, Northern Snakehead, and small killifish (Mummichog)
- The invasive species hydrilla was discovered in the Cayuga Lake Inlet and Erie Canal, New York. An aggressive eradication projects started at both of these locations in response to concerns about the spread of this invasive plant species throughout the Great Lakes basin. Despite signs of a successful control, eradication may take several more years due to the propagules that lay dormant in the sediment. <http://stophydrillawny.org/>
- A performance evaluation of early detection monitoring surveillance programs on Lake Superior that revealed opportunities to substantially increase the speed and sensitivity of detecting newly-introduced species. By focusing efforts on areas within ports known to carry rare and invasive species, and by increasing the use of sampling equipment that captures a wide diversity of organisms, the effectiveness at detecting invasive species has nearly doubled. To continue improvement in the future, the US-EPA and US-FWS have implemented an adaptive cycle of surveillance assessment, refinement, and implementation.

Conduct research to develop and test AIS detection, containment, and control technologies.

- Work was initiated on the development and testing of a near-real-time environmental DNA (eDNA) surveillance tool in order to support Law Enforcement efforts relating to illegal transport of Asian carp species into Great Lakes jurisdictions.
- The use carbon dioxide as an environmentally sound approach to help contain Asian carps in the Mississippi River system was tested. Results show promise of this containment technology at reducing the risk of Asian carps spread
- Work was initiated on the development and testing of a system to deliver a piscicide (Antymycin), into waters containing Bighead and Silver Carps, to reduce non-target environmental impacts. This technology could be used to reduce populations in the Chicago Area Waterway System and Illinois River, to minimize risk of establishment in the Great Lakes.
- New molecular genetic techniques are being developed as sensitive tools for detecting of rare invasive species. Current research efforts funded by GLRI have focused on expanding the use of

environmental DNA (i.e. “free” DNA found in water), genetic analysis of larval fish samples to screen for the reproduction of invasive fish, genetic analyses of lake sediments/benthos for detection of invasive species such as zebra mussels, quagga mussels, and spiny water fleas. The current trend of advancing molecular genetic methods coupled with decreasing costs is extremely promising.

- The sea lamprey mating pheromone, 3kPZS, was official registered in the U.S. as the first ever vertebrate pheromone biopesticide. Like an alluring perfume, the mating pheromone is a scent released by male sea lampreys to lure females onto nesting sites. The pheromone could be used to lure male sea lamprey into traps. Research and development of the mating pheromone was funded by the Great Lakes Fishery Commission, with additional support from the Great Lakes Restoration Initiative, in collaboration with federal government, university, and private industry partners.
- Based on extensive testing, the commercial product “Zequanox” was approved for open water use to combat invasive zebra and quagga mussels in lakes, rivers, recreation areas and other open bodies of water. U.S. agency and academic partners are exploring it’s strategic use in the Great lakes and inland lakes. Zequanox is composed of dead cells derived from a naturally occurring soil microbe, and it controls mussels in all life stages. Its active ingredient has low toxicity and presents little risk to non-target organisms.
- Extensive work is pursuing new methods to control the spread of invasive *Phragmites*. Ongoing research includes:
 - Federal funding is helping support research at Cornell University to identify insects that prey on *Phragmites*. The researchers are evaluating the host-specificity of each insect species in preparation for wide-spread releases of insects that may help control *Phragmites* populations.
 - USGS and its partners have identified the fungal microbes that are associated with non-native *Phragmites* and are working to find ways of disrupting the symbiotic relationship between the microbes and the plants.
 - Wayne State and USGS scientists are working on ways to silence important genes in *Phragmites* (e.g., those for flowering, seed set, and photosynthesis) in an effort to reduce its competitive advantage. Analysis of the transcriptome for *Phragmites* is currently underway and this year, scientists will begin to test gene silencing of photosynthesis in *Phragmites*. The next step will be to test the technology in the field and develop an application method that will be feasible over a large scale.
 - More information can be found at: <http://greatlakesphragmites.net/research/control-options/>

Assessment of the potential impacts of climate change on AIS.

- A climate change projection tool was developed that can project the AIS climate niche, within the Great Lakes Basin, under several climate change scenarios published by the Intergovernmental Panel on Climate Change (<http://www.ipcc.ch/>) for the years 2050 and 2070.

